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Health and Safety Implication of Demolition in Ghana

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Abstract
Today, demolition projects undertaking are complex in nature, demanding greater skill, experience and precision than ever before. Demolition works are associated with a lot of dangerous activities, which in one way or the other has a great hazardous influence on operatives and surroundings in respect to the adjoining properties. The risk involved in this activity is extremely high, which are concerned with various accidents in its process. The aim of this paper is to investigate into the health and safety implication of demolition in Ghana. The objectives are to the health hazard associated with the demolition operations, to identify the health implication of demolition on the site. To determine the precautions implemented during demolition of works on site. Observation and questionnaires were adopted to collect the data. Descriptive statistics involving the use of tables and percentages were used to analyse the data. The analysis of the data once again revealed that, noise pollution recorded 71.43% as the highest impact during demolition of works, followed by dust generation with 57.14%. Vibration also recorded 42.86% followed by hazardous substance and materials with 25%. Flying particles and debris, inhalation of toxic and unintentional collapse of structure recorded 21.43%, 14.29% and 7.14% respectively. It is also recommended that, all the workers goes through a proper job safety training and be informed of the potential hazards by attending sessions as well as on-the-job-training.
Keywords: Health, Safety, Implication, Demolition, Ghana

METHODS OF DEMOLITION

The Amity Contractor Pvt. Ltd (2000) and the Best Practice Guideline for Demolition in New Zealand, describes common ways of bringing down buildings and includes safety advice. In practice, more than one method can be used to demolish a building. These methods include:

Demolition by hand.

Hand demolition is not a quick method, because only hand tools are used. However, cranes and shear legs may be used to hold or lower beams during cutting. Chutes or crane-and-skip are usually used to get debris safely from the upper stories to the ground. Safe access must be provided. If work cannot be carried out safely on the building, a scaffold or machine lifted platform should be used.

Demolition with the ball

Most structures can be demolished by balling, but it is a skilled practice that cannot be self-taught. Balling is viable and effective method of demolition when demolishing multi-storey building structures that have suffered structural damage, where all other methods have been consider, and a hazard assessment has determined that this method is the most appropriate. Bn mb0op; Some guidelines and warnings are provided

- The boom angle when balling should not be more than 60 degrees to the horizontal. The top of the boom should not be less than three meters above the wall being knocked down.
- The SWL for the machine must be at least three times the weight of the ball.
- Always operate from outside the building.
- Any other building nearer than a distance equal to half the height of the building being demolish is in danger.
- Note the location of all overhead power lines and be aware of these when turning the crane from the normal work face.

Demolition by pusher arm

The pusher arm method is not suitable for large building on confined site, but it is good for masonry infill structures. The building is pushed over in stages by a horizontal force from the machine. An arm is fitted to the lower boom instead of a bucket. The arm is extended forward against the facing wall and the force of the excavator pressing forward provides the push.

When using this method, always take the following precautions:

- Ensure that the site has been secured safely to prevent unintentional entry by unauthorized personnel during demolition.
- Work from outside the building, and never let anyone enter the building while plant is wrecking the building.
- Be sure that the operator has been trained in the work, or is being instructed by a trained person.
- Separate the building from any attached buildings using hand method.

Demolition by wire rope pulling

This method is a form of deliberate collapse. The cables and wire ropes are fixed to key structural members, the pulled down by tractors or winches. It is suitable for detached buildings where there is plenty of surrounding room.

The method can be used for timber-framed buildings, bridges, brick, and masonry steel chimneys and for spires and masts.

When using this method, always take the following precaution.

- Use wire ropes o at least 16mm in diameter, and check them regularly. Wire ropes must have a factor of safety of 6.
- Do not let anyone stand between the tractor and the building, or beside the rope.
- Never let anyone enter the building while pulling is in progress.
- Ensure that the pulling ropes are kept clear of overhead power lines, especially when taking up the rope slack.

Explosion

Charges of explosive are placed within the fabric of structure and detonated to cause partial or complete collapse. Competent explosive specialist is required when demolition is to be done by using explosive.

When using this method, always take the following precautions:

- Have safe escape route open.
- Keep the public at a safe distance – a minimum of 200meters from the blast site; however, this is dependent on the type and quality of the explosives used.
- Plan and inform all employees of the execution plan

DEMOLITION HAZARDS

According to Kings and Hudson (2000), demolition worker faces a variety of hazards, which include but are not limited to:

Noise pollution

Noise pollution is due to the various operations taking place at the site, noise level may rise above the ambient level due to working machinery, blasting and falling masonry.

Dust generation

This occurs as a result of breaking or blasting the structure, as well as falling debris. This will depend on the wind direction.

Vibration

Especially from hand-held pneumatic tools.

Unintentional or unplanned collapse, inadequate shoring

Flying particles, causing eye and skin injury.

Toxic inhalation. Example Inhalation of Zinc fumes when cutting galvanized material.

Hazardous materials With the demolition of structures and buildings, especially older structures, comes the need to deal with hazardous materials. Through a building survey conducted by a qualified professional, the architect or engineer will know the types, extent, and condition of hazardous materials present.

The demolition contractor will use the services of a licensed abatement contractor (a contractor who specialized in the removal of hazardous material). (Wilson 1992)

Hazard management

Section 7 of the Health and Safety in Employment Act 1992, requires all employers to have in place an effective method for systematically identifying and regularly reviewing hazards in the place of work (existing, new and potential), to determine whether they are significant hazards an require further action. Where the hazard is significant, the Act sets out the steps employers must take:

1. Where practicable, the hazard must be eliminated (section 8)
2. If elimination is not practicable, the hazard must be isolated (section 9)
3. If it is impracticable to eliminate or isolate the hazard completely, then employers must minimize the likelihood that employees will be harmed by the hazard (section 10)

Where the hazards has not been eliminated or isolated, employers must, where appropriate:

i. Ensure that protective clothing and equipment is provided, accessible and used;
ii. Monitor employees exposure to hazards;
iii. Seek the consent of employees to monitor their health; and
iv. With informed consent, monitor employees' health.

(http://www.legislation.govt.nz/act/public/1992/0096/latest/DLM278829.html).

POTENTIAL IMPACTS OF DEMOLITION

Potential environmental impacts in connection with demolition works are but not limited to:

i. Noise
ii. Vibration
iii. Dust generation
iv. Air quality
v. visual quality

Noise pollution

Noise will affect the hearing system

Vibration

This has serious effects on both the workers and nearby building. Rubbles or pieces of Cracks may also appear in the building close to the site.

Dust generation

The dust generated may also have adverse effect on the workers eyes and either have serious eyes problems or blind them**.** The dust generated may also go into the atmosphere and fall back as acid rain caused by sulphur-dioxide and carbon-dioxide leading to global warming.

Air quality Demolition activities could create a temporary adverse effect on the local air quality of the site and its surroundings. These activities have the potential to generate dust, primarily from "fugitive" source (i.e. emission released through means other than tailpipe emissions from haul trucks, heavy demolition machinery). (King and Hudson,1985)

Visual quality

Demolition activities would create a temporary adverse effect on the visual quality of the proposed site and its surroundings.

PRECAUSIONARYMEASURES

According to Code of Practice for Demolition of Building, 2004, site safety features shall emphasize protection of the public, particularly, the pedestrian and vehicular traffic and the adjacent properties. Proper safety features shall be designed by the Authorized Person/Registered Structural Engineer to make sure that the demolition can be carried out safely and the site personnel is protected. This Registered Specialist Contractor (Demolition) shall carry out the demolition works including precautionary measures in accordance with the approved plans and other related documents, and provide continuous supervision to the works.

Hoarding and Covered walkway

The primary purpose of hoarding and covered walkway is to provide protection of the public during the construction or demolition of building. Generally, hoarding isolates the demolition site from the public, thus preventing unauthorized access and trespassing. The covered walkway in conjunction with catch platform provides additional protection to the pedestrian traffic against falling debris. The Authorized Person/Registered Structural Engineer shall design them to suit individual site circumstances.(Abdullah and Anumba 2002).

Temporary supports

Temporary supports to the structure or the element of the structure being demolished shall be provided for any or combination of the following conditions:

i. When any part of the structure or any element being demolished is not self-supporting
ii. When temporary stability of the structure or its elements could be impaired as a result of the demolition activities.
iii. When the whole or any part of the structure is subjected to excess loading derived from the demolition activities, movement of powered mechanical plants or debris accumulation.

Temporary supports shall not be removed until its supporting loads are completely removed.

Adjacent building

Temporary supports shall be provided to adjacent properties including, but not limited to, buildings, public or private utilities, slopes, retaining walls or land when the removal or any part of the building being demolished could affect the stability of such properties. Common features, such as truncated continuous harms, exposed party walls and walls common staircases, shall be protected and stabilized. Safe ingress and egress for adjoining properties shall be maintained and appropriate supports to brace the structure shall be installed.

Incomplete Demolition Projects

When a demolition project is shut down for a prolonged period before its completion, the remaining structure, if any, shall be stabilized by temporary support and/or bracing systems.

Special safety considerations

Demolition workers shall go through proper job safety training and be informed of the potential hazards by attending training sessions as well as on-the-job training.

The safety concept can be maintained by regular safety meetings throughout the project period. Site safety attitude may be cultivated by strict enforcement of the safety regulation by the site supervisor. (Best Practice Guideline for Demolition in New Zealand, 2011).

FINDINGS AND DISCUSSION

Table 1.Degree of impact of demolition hazards

HAZARDS	Degree of associated impacts of demolition hazards on site						TOTAL	
	LOW		HIGH		VERY HIGH			
	No of response	%	No of response	%	No of response	%	No of response	%
Flying particles and debris	22	78.57	6	21.43	0	0	**28**	**100**
Vibration	16	57.14	12	42.86	0	0	**28**	**100**
Dust generation	2	7.14	16	57.14	10	35.71	**28**	**100**
Noise pollution	6	21.43	20	71.43	2	7.14	**28**	**100**
Inhalation of toxic	23	82.14	4	14.29	1	3.57	**28**	**100**
Unintentional collapse of structure	26	92.86	2	7.14	0	0	**28**	**100**
Hazardous substances and materials	21	75	7	25	0	0	**28**	**100**

Source, Field survey

The response received revealed that dust generation has a very high impact with 35.71% followed by noise pollution with 7.14% and inhalation of toxic with only 3.57%. The rest of them recorded 0%. Twenty (20) respondents constituting 71.43% records noise pollution to be higher in nature as per its associated impact, followed by dust generation with 57.14%. Vibration also recorded 42.86% followed by hazardous substance and materials with 25%. Flying particles and debris, inhalation of toxic and unintentional collapse of structure recorded 21.43%, 14.29% and 7.14% respectively. Again in assessing the various demolition hazards with a lower level of impact, 26 respondents constituting 92.86% went in for hazards arising from unintentional collapse of structure, with 82.14% going in for inhalation of toxic and 78.57% also going for flying particles and debris. Hazardous substance and materials, vibration, noise pollution, and dust generation also recorded 75%, 57.14%, 21.43%, and 7.14% respectively. The above results explain the fact that, in almost all demolition operations, the rate of dust and noise as compared to the others (hazards) is very high.

Summary of Findings

From the analysis of the questionnaires, it came to light that adequate safety measure are not mostly put in place on some demolition sites in the Accra metropolis to control hazards. The following points were revealed.

a) Workers are mostly not provided with safety clothing or protective equipment on some demolition sites.
b) The public are also exposed to excessive dust or flying particles. This is because little is done on some demolition sites to prevent or minimize these hazards.
c) Some of the workers gets themselves injured in the process and mostly with manual method of demolition
d) Most demolition sites are also not fenced or hoarded

Conclusion

The analysis of the data once again revealed that, most of these problems or situation occurs as a result of inadequate measures taken in ensuring safety on some demolition sites and its surroundings, the absence of adequate personal protective equipments for operatives, and untrained personnel or workers who are allowed on some demolition sites to undertake such activities. In recognition to the research carried out, it can therefore be concluded that, hazards on demolition sites can never be prevented yet basic safety measures and the need for constant vigilance on site can solve or reduce most of these hazards. Regulation (54) of the National building regulation 1996 provides guidance for essential safety requirements making major impact on improving safety in demolition works.

Recommendations

1.All workers on site must be made aware of the hazards that they could be exposed to with the method employed on site if they do not adhere to safety precautions. This could be done through placing of posters around and notices at points on the site.

2.Project managers or directors should ensure that the site is well fenced or hoarded. This will prevent unauthorized access and trespassing on the site. Covered walkway in conjunction with catch platform must also be constructed to provide protection for pedestrian traffic around the site against falling particles or debris.

3.It is also recommended that, all the workers goes through a proper job safety training and be informed of the potential hazards by attending sessions as well as on-the-job-training. Also, only well trained personnel or those with the full knowledge of various techniques of demolition should be allowed to carry out the work.

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